SYSTEMS MODELING TO ENHANCE ECONOMIC CONSCIOUSNESS FOR PUBLIC INVESTMENT IN INDIA

A

SYNOPSIS

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SECTION I

INTRODUCTION

1.1 Economy and Investment

Economic growth is calculated by the increase in a country's total output or real Gross Domestic Product (GDP).

1.1.1 Global Economy (Current Scenario)

Social and economic conditions of one country or region have a significant impact on growth prospects in another country or region. Thus, global economic growth prospects are heavily influenced by the financial growth / crisis across countries and regions around the world. Economists argue that the unexpected slump in global economic growth in the last few years is an impact of the weakening of trade and investments in various developed and developing economies around the world. The global economy registered a low of 2.4 percent in 2019 from 3.0 percent in 2018.

Unfortunately, the outbreak of the pandemic novel coronavirus disease (COVID 19), starting from the city of Wuhan, China sometime in November/December 2019 and spreading like wildfire to almost every other country has assumed alarming proportions, infecting and subsuming millions of humans across the globe. As of 25th May, 2020, over 5.5 million persons have been found infected by COVID 19 and over 340,000 have reportedly succumbed to it. Apart from being a severe public health challenge snowballing into many other far reaching consequences, this has sent many countries into a state of hibernation, spelling a deep global economic crisis.

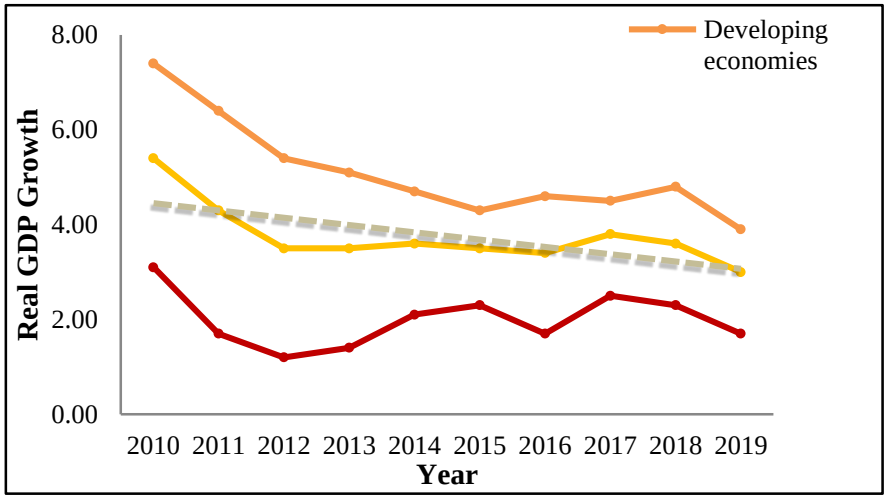

FIGURE 1: SOURCE: INTERNATIONAL MONETARY FUND (APRIL, 2020): WORLD ECONOMIC OUTLOOK

Figure 1 indicates the real GDP growth rate of the advanced economies, developing economies and the world. Real GDP is understood as a macroeconomic measure to analyze economic growth. Real GDP calculates the value of the goods and services produced by an economy in a specific period, adjusted for inflation.

As Figure 1 indicates, a global decelerated growth has been witnessed. This slump can be attributed to various economic shifts in the following regions:

United States: Despite the recent trade deal with China, U.S. has witnessed a decelerating economic growth with the slowing investments and exports. In addition, rising tariffs have increased trade costs, while policy uncertainty has weighed on the investment and confidence of the economy. The U.S. manufacturing sector has also been very weak. Prior to the outbreak of COVID 19 in the US sometime in March 2020, it wasalready expected to witness slower economic growth i.e. from 2.3 percent in 2019 to 1.8 percent in 2020 and 1.7 percent in 2021-22, primarily because of the negative impacts of uncertain policy changes and a fading contribution from tax cuts and government spending. But the lockdown imposed by The US government led to shrinking of its economy by 5% in the first quarter of 2020 with about 33 million workers rendered jobless. The disease is spreading even now and it is difficult at this stage how much further damage it will cause. The possibility of the US going into recession cannot be ruled out.

Euro Zone: Several economies of the Euro Zone faced economic crisis at various points of 2019, such as the German industrial sector, as it struggled with falling demand from Asia and disruptions to car production. Uncertainty concerning Brexit also added to the pressure on the region. According to World Bank projections before COVID 19 struck Europe early this year, because of declining industrial productions, economic growth was expected to slow to 1 percent in 2020, which was 0.4 percent lower than the last projections. Now, post COVID 19, the European Economic Forecast of Spring 2020 has predicted that the EU GDP would contract by about $7^{1/2}$% this year and has announced that EU has already entered into the deepest economic recession ever.

Japan: Two major factors behind the sharp decline in economic activities in japan were, (1) Nature Disaster, Typhoon Hagibis and, (2) the increase in the value-added tax (VAT) in October, 2019. Thus, even prior to being struck by the pandemic caused by COVID 19, the economy was expected to

witness a slump from 1.1 percent in 2019 to 0.7 percent in 2020. Weakness in manufacturing and exports, particularly to China, and the decline in consumption patterns were also important factors behind the negative economic shift. COVID 19 has further led to decline in exports, out, demand from overseas tourists and private consumption. World Economic Forum has reported the results of a survey of over 10,000 Japanese businesses, where at least 63% of them projected a negative impact of COVID 19 on their business.

China: With the decrease in domestic demand and increase trade tensions, the Chinese economy was witnessing a decelerating growth before COVID 19 erupted from Wuhan. Trade policy uncertainty and higher tariffs on trade with the United States weighed on investor sentiment for most of 2019. In addition, Industrial production growth and trade flows substantially weakened, where, imports, (intermediate goods) were reduced. The fall in imports was higher than the fall in exports, indicating a decline in domestic demand. Though COVID 19 virus originated in China, the pandemic it caused has got controlled there, but not without significant dent to its economy. TIME (April 21, 2020) has reported that China's economy contracted by 6.8% in the first quarter of 2020, with the closure of about 460,000 Chinese firms.

South Asia: South Asia's growth decelerated to 4.9 percent in 2019 from 7.1 percent in the previous year, primarily due to the two largest economies, India and Pakistan. Weak confidence, liquidity issues in the financial sector (India), and monetary tightening (Pakistan) caused a sharp slowdown in fixed investment and a considerable softening in private consumption. Export and import growth for the region as a whole moderated, in line with a continued slowdown in global trade and industrial activity. Business confidence was hampered by subdued consumer demand in India and security challenges in Sri Lanka. With COVID 19 onslaught, according to the World Bank forecast, the South Asian region is likely to witness the worst growth performance in the last four decades. While economic growth will see a sharp decline in India, Sri Lanka, Nepal, Bhutan and Bangladesh, Pakistan, Afghanistan and Maldives are expected to go into recession.

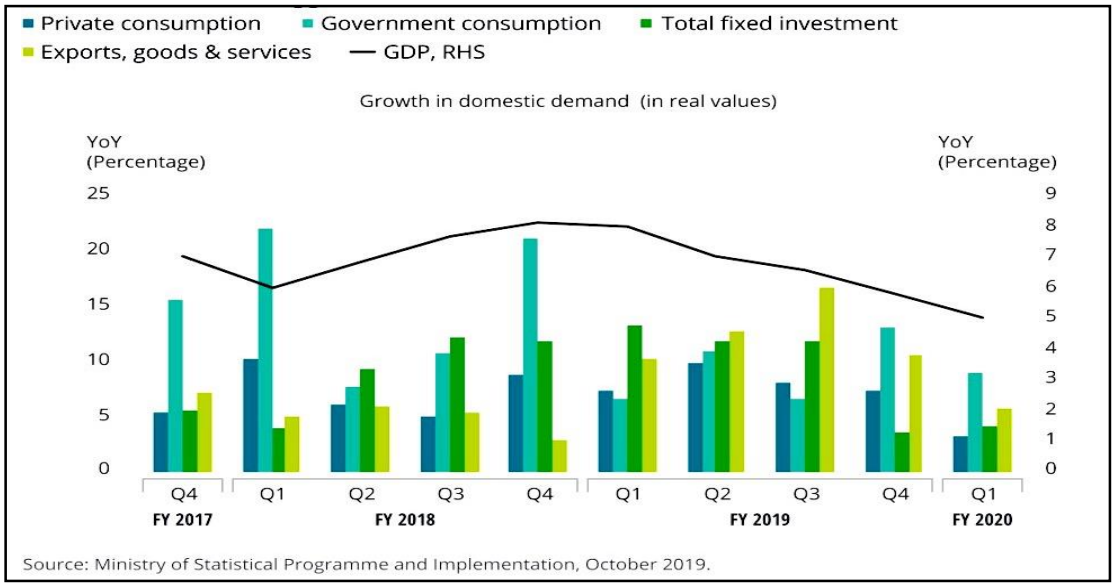

FIGURE 2 . SOURCE: INTERNATIONAL MONETARY FUND (APRIL, 2020): WORLD ECONOMIC OUTLOOK

1.1.2 National Economy (Current scenario)

India witnessed a GDP growth of below 6 percent (year over year) for two consecutive quarters of FY 2019 and the growth rate has been consistently slowing down since the year 2016 onwards (Figure 2). More specifically, GDP growth decelerated to 5 percent and 4.5 percent in the April-June and July-September quarters of 2019, respectively. This deceleration was distinctively influenced by the declined growth rates of the Indian manufacturing and agriculture sectors. Though, government-related services received noteworthy support through public spending, primary growth engines such as, private consumption, private investment and exports slowed down significantly (Figure 3).

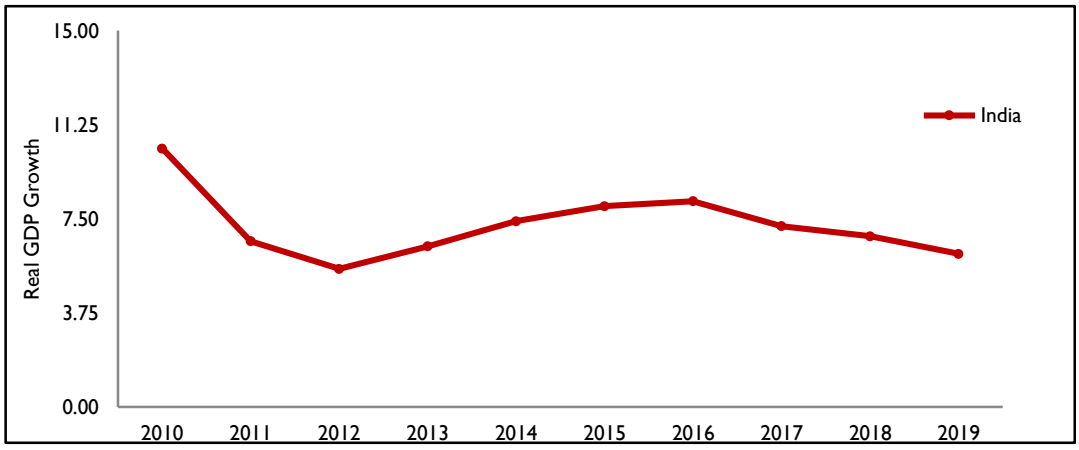

FIGURE 3. SOURCE: MINISTRY OF STATISTICAL PROGRAMME AND IMPLEMENTATION, OCTOBER 2019

It is argued that the decline in consumption and purchasing power is the prime contributor of growth decelerating to 3.1 percent in Q1 FY2019–20. The decline in consumption and purchasing power has

evidently been observed in the domestic auto sales in India, with the overall auto industry reporting a decline of 23.55 percent in August 2019. India witnessed a prolonged downfall in the passenger vehicle segment in nearly 19 years, slumping by 30.98 per cent in July 2019. Furthermore, according to media reports, with approximately 1.5 million houses (about 5 percent of GDP) lying unsold, the Indian real estate sector suffered the worst-ever slowdown.

This national economic slowdown could be understood as a supply-side problem and a downfall in domestic demand. That is to say, declining demand for goods and services is attributed to several factors, such as a stagnation in rural incomes, sharp increase in unemployment and rigid lending capacities due to poor conditions of financial institutions. The supply side problem could be associated with excess production and weakening corporate profits, which had a negative impact on the investment in production facilities and hiring.

So, while the Indian economy was already slowing down, the pandemic caused by COVID 19 has given another jolt to it. The World Bank expects Indian economy to grow between 1.5 % and 2.8% during the 2020-21 fiscal year that started from April.

Pre-COVID 19, a number of policy announcements to enhance the demand and supply side problem were made by the Indian Government to cater to the decelerating economic growth, such as, liberalization of FDI norms for select sectors; rollback of recently introduced and much debated tax surcharge on foreign portfolio investors; incentives to support several industries; bank consolidation; and the blockbuster cut in the corporate tax rate. These measures were expected to improve credit growth, increase capital inflows, reinvigorate private investments and hiring, and thereby accelerate economic growth.

To address the concern of poor domestic demand, i.e., consumption of fewer goods, resulting in cuts in production and investment. The government had also announced a lower corporate tax rate; as companies were likely to increase hiring and investments. Further, higher profitability were likely to result in better asset valuations and improved wealth, resulting in an increased demand with the increased spending capabilities.

Further, India had recorded a noteworthy jump in ‘ease of doing business’ rankings by the World Bank (a jump from 132 in 2011 to 63 in 2019 out of 190 countries). Thus, India had of late become a

significant destination for multinational companies looking for alternative manufacturing destinations to diversify their supply chain. In addition, the upswing in the capital market after such announcements was indicating a positive shift to the economic scenario. Bang came COVID 19 and disturbed the applecart.

However, the Indian Prime Minister's announcement on 12th May, 2020 to provide a Rupees 20 lakh crore stimulus package to save the lockdown battered economy has raised some hopes. Such a mega relief, amounting to about 10% of the GDP, if utilized judiciously, may lead to reversal of the economic downturn earlier than expected otherwise.

1.1.3 Role of Public Investment in Economic Development

Investment within the country is the primary activity that leads to a strong economy. To varying degrees, investment is important for a strong economy in all institutional sectors, including private companies, households, and public sector. Investment plays a highly significant role in achieving macroeconomic goals. It increases domestic expenditure and production capacity, and leads to modernization of production processes, leading to improvement in cost-effectiveness. It reduces the requirement of labour, and promotes value-added production. It also incorporates world-class innovations and quality standards.

Some of the common problems of developing economies are inadequate infrastructure, lack of healthcare facilities, unemployment, and lack of funds. At the same time, they are keen for rapid economic development. Since the private sector is generally unable to find and invest huge funds for developmental work, it cannot be expected to play a major role for economic growth on its own in such economies.

Economic overheads like efficient roads and railways, irrigation facilities, and power projects are essential for economic growth. Similarly, social overheads like hospitals, schools and colleges etc. are also important for balanced growth. Moreover, backward and under-developed regions require adequate attention for overall growth. Further, proper exploitation of natural resources like minerals, coal, crude oil, etc. is necessary for development. Similarly, for growth in agriculture, facilities provided by warehouses, fertilizer factories, industries dealing with agricultural machinery, etc. are

also required. Such requirements make it imperative for the governments to invest and provide the necessary social and economic base for further progress.

1.1.4 HISTORICAL PERSPECTIVE OF PUBLIC INVESTMENT IN INDIA

To carry out centralized and integrated national economic development, independent India embarked on a planned approach through a series of Five-Year Plans until 2017. The expenditure incurred under these Five-Year Plans was categorized as planned expenditure and the rest of the expenditure fell in the category of non-planned expenditure. Generally, that component of government expenses which is aimed at raising the productive capacity in the economy is termed as plan expenditure, and is part of budget estimates determined after deliberations in the parliament. Whereas, non-plan expenditure is mostly fixed and obligatory in nature. With the replacement of Planning Commission of India (1951-2014) by NITI Aayog in 2015, the planning process is now carried out in the overall charge of the latter. Further, the government has recently decided to do away with the distinction between plan and non-plan expenditure.

From the First Five-Year Plan (1951-1956) to the Twelfth Five-Year Plan (2012-2017), the successive Planning Commissions adopted a focused approach to develop irrigation, community development, rehabilitation of landless farmers, power projects, employment opportunities, healthcare facilities, higher education, etc. through various plans and programs at the central and the state government levels.

The Eighth Five-Year Plan (1982-1987) was a turning point in the history of Indian economy, though it could not take off in 1990 due to the flux in the economic situation, and the planning process got confined to the annual plans of the years 1990-1991 and 1991-1992. However, once formulated, the Eighth Plan brought in liberalization, privatization, and globalization (LPG) in India. During this period, India became a member of the World Trade Organization on 1st January, 1995. The Eighth Plan also led to modernization of industries and gradual opening of the Indian economy to deal with the problem of fiscal deficit and foreign debt.

While public investment by successive governments has led to significant growth of the Indian economy, a major drawback has been the increasing burden of tax on the tax payers and questionable expenditure on the government machinery. From time to time, efforts have been made by the

government to curtail such expenditure by adopting austerity measures but the proportion of expenditure of the government on itself continues to be substantially high (27% of GDP in the year 2018-2019). Another drawback has been that the targeted funds do not reach the ground-level beneficiaries not only due to the inefficiencies in the public investment system, but also because of significant information deficit. The rural population quite often does not know about the welfare schemes meant for them. For instance, in Uttar Pradesh, a budgeted amount close to Rs. 100 crore for minority welfare schemes remained unspent between the years 2013 and 2017. In Karnataka, only 2.44 % of the budgeted Rs. 50 crores (approximately) could be spent on welfare schemes for workers, due to lack of awareness of such programmes and problems like inequality in distribution of income have remained unsolved.

1.2 SYSTEMS APPROACH TO PROBLEM SOLVING

A system is generally described as the sum of its parts, and is understood to be more than the sum of its parts (Gestalt philosophy). In Physical Sciences, a system can have clearly defined boundaries, but in Social Sciences, such boundaries are usually blurred. However, General Systems Theory is applicable to all kinds of systems in order to provide a holistic understanding of the concerned system. Ludwig von Bertalanffy proposed General Systems Theory to study the complexity of interacting elements of a system within itself as well as with the environment around it. In systemic perspective, the connections between various elements of a system as parts-to-whole and whole-to-parts are important as they fit together to form a whole.

1.2.1 POLICY FORMULATION MODEL AND PROCESS

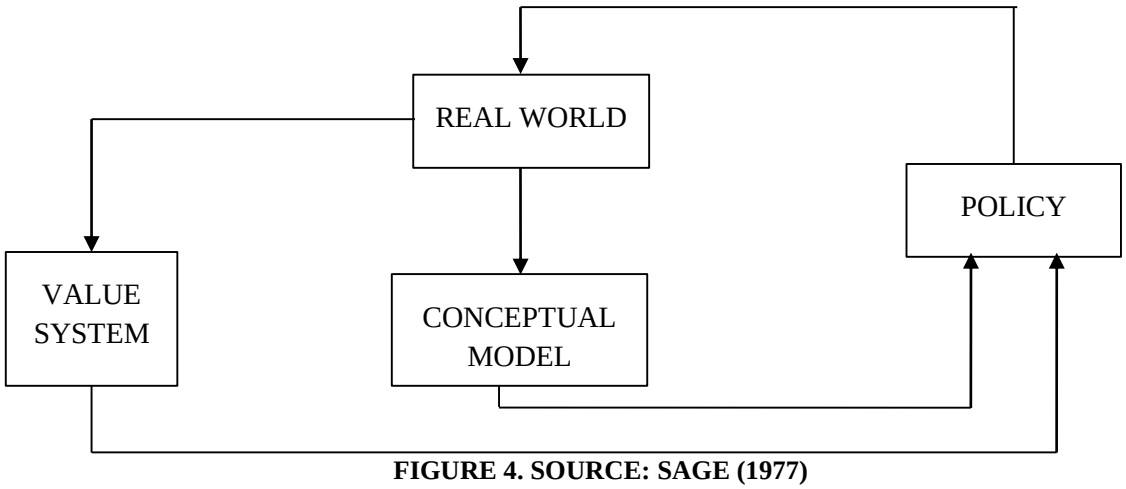

FIGURE 4. SOURCE: SAGE (1977)

To a human being, the real world idea of any system is a representation of that system at his/her mental plane. Human mind interprets the perceived elements of a system and their inter-connections as a model to maintain coherence and relate it with the rest of cognitive processes. Such mental models shape our holistic understanding of the real world. In the context of formulation of policy for a given system, its mental model provides the conceptual basis derived from the perception of the real world. The conceptual model leads to the inputs for designing policy relevant to the system concerned, and receives feedback for fine-tuning the policy. At the same time, the policy formulation is also determined by inputs of the value system from the real world, which in turn depends on the feedback of the policy in the real world, as represented in Figure. 4.

1.2.2 NEED FOR SYSTEMS APPROACH

Mental models help the human mind to simplify complex real world systems into organizable constructs for making sense out of them. However, due to individual differences in perception of the real world, mental models for the same system may be different for different individuals. Complexity of the real world systems, together with different individual mental models, often makes it difficult to reach a consensual understanding of any given real world system. Such a condition is detrimental to development of sound policy formulations to regulate real world systems, particularly socio-economic systems.

Systems approach seeks to develop consensus amongst the domain experts of the concerned system to arrive at an agreeable understanding and translate their mental models into a tangible system model that can be used for table-top policy formulations. Therefore, to avoid ambiguity and attain clarity for commonly acceptable understanding of a real world system (by the experts and policy makers) like the public investment system, systems approach can provide a sound knowledge of the system elements and their interconnections for planning and implementation of the desired economic policies.

SECTION II

LITERATURE REVIEW

TAXONOMY OF LITERATURE

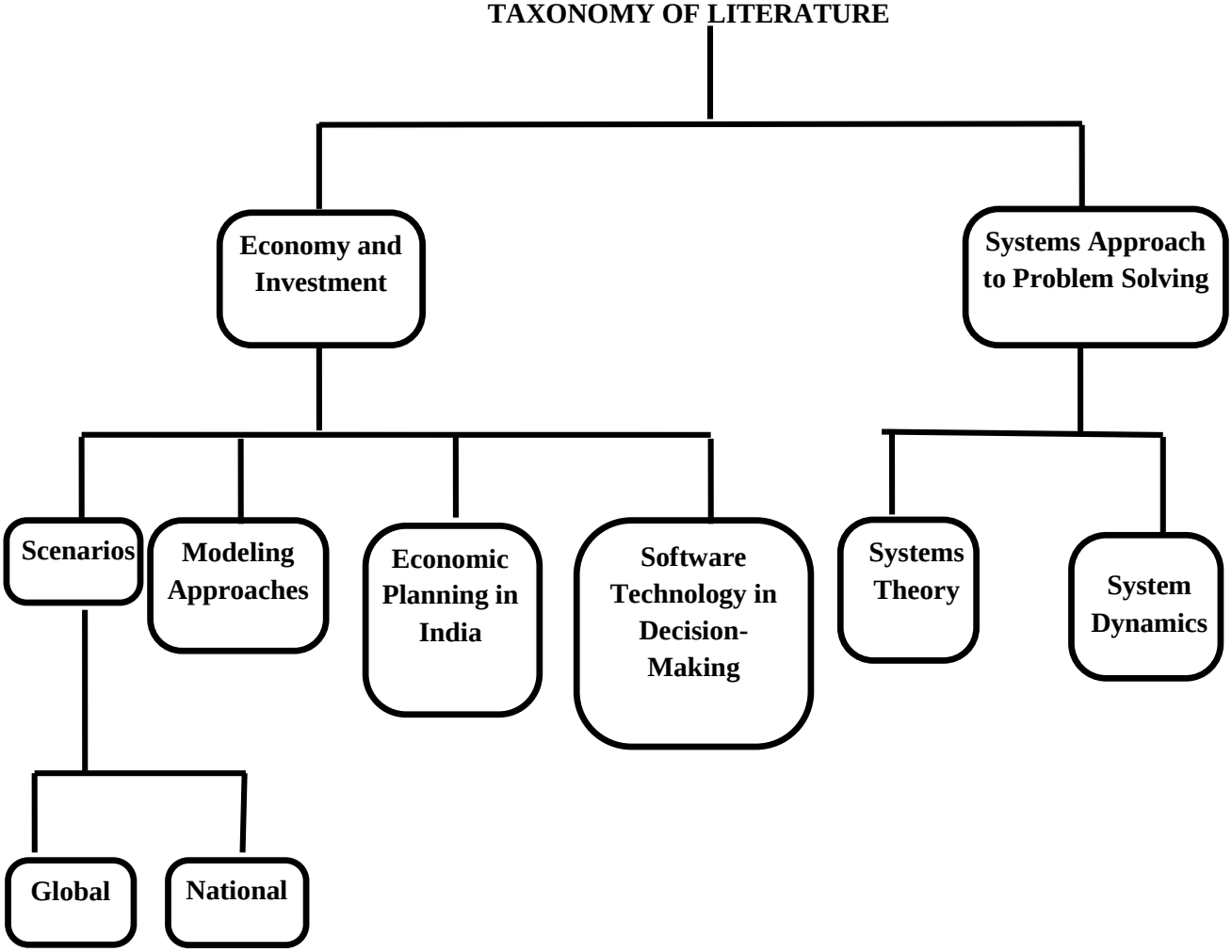

FIGURE 5: TAXONOMY OF LITERATURE REVIEW

The literature review has been conducted taxonomically, as indicated in Figure 5.

2.1 ECONOMY AND INVESTMENT

2.1.1 GLOBAL SCENARIO

Afonso and Aubyn (2018) have reported from their study on the macro-economic effects of public and private investment in 17 OECD countries on the basis of relevant data from 1960 to 2014, that public investment showed positive growth in most of the countries and private investment had a positive impact in all the countries covered under the study.

On studying the macro-economic effects on public investment in advanced economies, Abiad, et. al. (2016) found that both short-term and long-term outputs improved with increase in public investment.

They also noticed that such effects are stronger during slack periods and response of output to public investment increases with improvement in investment efficiency.

Furceri and Li (2017) have reported new empirical evidence in favour of positive impact of public investment on short and medium term outputs. They have also found reduction in inequality of income with increases in public investment.

The role of public investment in social and economic development has been emphasized by the United Nations. However, it is cautioned that particular attention, especially in the case of large and ambitious investment programs is necessary because, "…opportunities for inefficiency and waste can be substantial." In such cases, institutional mechanisms for evaluating and prioritizing the investment programs are worth of consideration.

2.1.2 NATIONAL SCENARIO

The government has rarely relied upon feedback on performance while making budget allocations, barring a few exceptional planned programs. Budget planning in the past has rarely been based on scientifically assessed financial needs. Rather, resource availability, political dominance, and schemes that gain popularity often get precedence in financial allocations.

Taking cue from the figures released by the Central Statistical Organisation (CSO) on 29.05 2020, which include GDP growth plunging to a 11-year low in FY2019-20 at 4.2% and further to 3.1% in the January-March 2020 quarter, Bhusnurmath (2020) has analysed and reported that the economy had slowed significantly, well before Covid-19 hit the Globe. Not much can be expected from the stimulus package of Rs. 20 lakh crores, and the efforts of RBI by repeated reductions in repo and reverse rates, and other financial and regulatory measures will not result in increased credit offtake. Due to the ongoing pandemic caused by the spread of Covid 19, it is difficult to make a realistic assessment of growth at this point in time.

2.1.3 MODELING APPROACHES

Melina, et.al. (2016) have developed Debt, Investment, Growth, and Natural Resources (DIGNAR) model to analyse macro-economic and debt sustainability effects of scaling up public investment. This model is specifically applicable to resource-rich developing countries. The model tackles typical problems of such countries like investment deficiency and limited absorptive capacity.

Alter, et.al. (2017) have analyzed the trade-offs between savings, debt, etc. with looming oil exhaustibility concerns in a developing country, and found moderate scaling up of public investment in the short term as an optimal policy for maximizing welfare and preserving capital and fiscal sustainability.

Fournier (2016) in a working paper from Economics Department of OECD has estimated baseline convergence model that captures the long-term effect of human capital and physical investment on potential output for a panel of OECD countries and found a positive impact of public investment on long-term growth and labour productivity. He has also found evidence that the gains from the increasing public investment may follow the law of diminishing returns at a high level of the public capital stock.

In a range of simulations using three different macro-structural models, Mourougane, et.al. (2016) have identified the conditions under which public investment can be raised to sustainably lift growth without adversely affecting public finances. In their simulations, they found that OECD countries could finance a half percentage point of GDP investment led stimulus without any increase in debt-to-GDP ratio in the medium-term. This could be done for three-four years on average provided the projects are sound.

2.1.4 ECONOMIC PLANNING IN INDIA

In India, planning is the joint responsibility of the central and the state governments. Administrative and institutional arrangements available in the country are expected to ensure the execution of planned programs. According to Nath (2009), four areas are considered of prime importance for planning tasks. They are: (i) agricultural and related developmental plans (land reclamation, soil conservation, irrigation, animal husbandry, etc.), (ii) development of industries, power, communication, etc.,(iii) development of social services (irrigation, medical, etc.), and (iv) urban development.

Sengupta (2016) has expressed apprehensions upon dissolution of planning commission as the apex planning body. She has argued that National Institution for Transforming India (NITI Aayog), which is a replacement of the planning commission is unlikely to spur innovative thinking by experts or promoting cooperative federalism by the state government. Instead, the new institution is likely to enlarge the power of the executive government and the prime minister.

NITI Aayog does not have constitutional status and is therefore not independent of the government. Unlike the planning commission, it does not involve many stakeholders to represent a large, diversified and democratic setup of the country. It is argued that the policies formulated by NITI Aayog are based on “one size fits all “approach. Since majority of states in India are not financially self-sufficient, they depend heavily on the grants from the center. Therefore, planning is expected to play a significant role for desired economic and human development in India.

2.1.5 ROLE OF SOFTWARE TECHNOLOGY IN INVESTMENT DECISIONS

Ivanov, Snihovyi, and Kobets, in the paper ‘Implementation of Robo-Advisors Tools for Different Risk Attitude Investment Decisions’ (2018), concluded that Robo Advisors, despite the criticism they receive, can help in making investments easier. Ivanov, et.al. also wrote that Robo Advisors can provide new tools and radically change an investment landscape.

2.2 SYSTEMS APPROACH TO PROBLEM-SOLVING

2.2.1 SYSTEMS THEORY

Literally, a system is a group of interacting or interrelated entities that form a unified whole. In systems theory, it is common to visualize the whole as a sum of its constituent elements and much more than that. Ludvig von Bertalanffy (1969) is credited to have first presented the idea of a General Systems Theory. He viewed systems as an alternative to the reductionist methodology and emphasized interdisciplinary approach to study interactive relationships in a system.

A complex system may have a large number of components interacting in multiple ways. In closed physical systems, the system boundaries are well defined, but socio-economic systems are generally porous and more complex in terms of the relationships between various stakeholders of such systems. Complexity of socio-economic systems leads to problems that may have to be tackled with a holistic approach. Systems Science tools and methodology have been successfully applied to deal with such problems in different parts of the world.

Ashby (1956) came up with the Law of Requisite Variety which states that a problem or situation can be controlled or solved better if the variety of solutions is at least as much if not more than the complexity of the problem or situation at hand.

While providing an overall account of the proceedings of a National Workshop on Select Dimensions of Rural Energy Systems held in Delhi in 1981, Satsangi and Gautam (1983) have lucidly explained the application of various tools and techniques of systems science, which can be applied to any large-scale system. They have applied NGT, Delphi Technique and Harva Scenario Building approach in the context of rural energy management to arrive at optimal solutions.

Keeney, et.al. (2001) have provided a critical review of the Delphi technique a a research methodology from a range of perspectives. They have analyzed important aspects of Delphi process, like sampling, anonymity, use of experts, iterative method, etc. and opined that the technique has much to offer in consensus building on specific topics.

Srivastava (2019) has applied the technique of ISM and Analytic Hierarchy Process in developing an Interpretive structural model of Indian Railway security system, and evaluating the option profiles, respectively, empowering the policy makers entrusted with the responsibility of security management in Indian Railways.

2.2.2 SYSTEM DYNAMICS MODELING

System Dynamics has been extensively been used to model socio-economic systems. Nguyen, et al. (2017) have applied System Dynamics approach to assist decision makers about the desirability of transport infrastructure investment options by enabling them to obtain a dynamic view that explicitly illustrates the cost and benefit relationships between component entities over time.

Gonçalves (2019) has applied System Dynamics to improve social good. By citing three examples, he has explained how System Dynamics modelling can be used to control HIV / AIDS under multiple policy scenarios, to allocate limited funds between two infectious diseases when faced with the difficult choices, and to show how short-term thinking can ultimately damage an organization’s core capacities while investment in building capacity pays off in the long run. Thus, System Dynamics modelling is a powerful method to address the dynamic complexity for better management of socio-economic systems.

SECTION III

CONCEPTUALIZATION OF THE PROBLEM

The problems in the public investment system of India have been conceptualized in terms of its complexity and vulnerability.

3.1 COMPLEXITY OF THE PUBLIC INVESTMENT SYSTEM

The Indian government has inherited its practices of governance from the British era, which was designed for serving the interests of the British government in India. While economic planning was undertaken in independent India through successive Five-Year Plans, the bureaucratic system continued to function on the same lines as that of the pre-independence era. The heavily staffed government offices with various hierarchical levels and redundant procedures tend to unnecessarily consume time and other resources, leading to an avoidable drain on the economy. With increasing requirement of funds to meet government expenditure and to cover the deficit, the practice of raising the tax burden has been quite common in most of the developing countries, including India. So, while public investment for development may be necessary on the one hand, the rising tax burden on the taxpayers promotes tax evasion and turns out to be counter-productive in many ways.

The recent step of demonetization in India, aimed at rooting out corruption and the menace of black money, has generated a lot of debate regarding its success in the purported direction. One criticism of this step has been that adequate attention was not given to various factors like its impact on cash-based transactions in the unorganized sector, the loopholes that could be exploited by unscrupulous players in converting black money to their advantage, lack of preparedness of banks to deal with the transactions that followed the announcement of demonetization, and so on. It appears that the complexity involved in demonetization seems to have been overlooked, due to which there are significant differences of opinions of experts in assessing as to whether the demonetization exercise has led to a positive impact or left unsolved puzzles in the Indian economy.

Most of the developmental activities, where poor and weaker sections of the society are expected to be the beneficiaries, are undertaken through the district administration. Unfortunately, many of the deserving beneficiaries are illiterate and unaware of the government policies and programs. They often fail to demand for their due share appropriately from the district officials. There are reports that the

corrupt district officials fail to spend as per the desired policies and programs of the government. The monitoring mechanism also leaves much to be desired to ensure proper implementation of government policies and programs.

Many times, public investment for developmental works at the local level get jeopardized due to lack of planning and coordination. For instance, a common problem observed at the ground level is that action for lying of electrical cables or sewer lines may follow construction of roads because the concerned projects are not planned in coordination, no sequential completion of projects is organized and decision makers may be far removed from the ground conditions. Therefore, it appears that the complexity involved at the lower level is not realized or given adequate attention by the higher administration.

3.2 VULNERABILITY OF THE PUBLIC INVESTMENT SYSTEM

In the era of liberalization, privatization, and globalization (LPG), the economy is subject to various internal and external market pressures. The internal disturbances like militant or terrorist activities, agitations by vested interests, bandh calls and strikes, etc., disrupt the growth and cause a drain on public funds. Further, financial scams, bank frauds, etc. also hit the economy as and when they occur.

At the international level, the fluctuating crude oil price, foreign trade restrictions, international conflicts, and sanctions thereof, global recessionary trends, and the like, cause a direct impact on the Indian economy and may adversely affect the planned programs of the government. Further, wars, natural calamities, and other unforeseen events like the pandemic caused by the spread of COVID-19 virus, leading to complete lockdowns in various countries (including India), have far-reaching consequences on the public investment system. Such vulnerabilities at the national and the international level pose difficult challenges to the government and disturb the developmental plans.

SECTION IV

NEED AND OBJECTIVES OF THE PROPOSED RESEARCH

4.1 NEED OF THE STUDY

The planned approach adopted by Indian Government for investing public funds in developing the Indian economy after Independence has certainly paid dividends in terms of industrial growth, progress in economic infrastructure, development of science and technology, improvements in

education and health care, growth of the service sector, and the like. But it has so far failed in reducing the inequality of income and wealth, checking the growth of black money, providing employment to the increasing numbers of labour force, implementing land reforms, alleviating poverty to the desirable extent, and so on. Proof of the pudding lies in its taste. The very fact that many important goals could not be achieved in spite of a fairly long history of economic planning in India indicates that there was something amiss. These shortcomings in planning are a result of the gap in the planning process and in the implementation of the planned activities due to difficulties in addressing the complexities and vulnerabilities that impact the achievement of the desired developmental goals.

Dealing with complexities and vulnerabilities requires adoption of suitable methods while planning. Systems approach to policy formulation is a proven strategy to deal with complex problem[37]. As systems approach takes into account the various elements of the systems and their relationship with each other, the dynamics of the system gets captured in a holistic manner and ambiguities disappear. This enables the decision makers to design suitable policies to achieve the desirable goals.

By invoking Ashby's Law of Requisite Variety, complexity can be matched by the variety of solutions to tackle any systemic problem [38]. Purity of thought and a large number of degrees of freedom in the solution set are inherent in the Dayalbagh way of life for tackling any kind of problem. With the availability of some domain experts from Dayalbagh, an institution like DEI, in collaboration with another reputed institute of higher learning, namely IIT Delhi, appears to be a suitable ground for the kind of research proposed here. It would be pertinent to mention that a Nobel laureate Shri Abhijeet Bannerjee, in his interaction with Director, Delhi School of Economics, Dr. Pammi Dua, and other representatives of Dayalbagh, was pleased to learn about the initiatives of Dayalbagh, and even expressed his desire to visit Dayalbagh. No wonder so, because while the rest of the world was reeling under the onslaught of COVID 19 pandemic, life in the Dayalbagh ecosystem went about just as usual due to impeccable planning and implementation of relevant measures.

4.2 OBJECTIVES OF THE STUDY

As per discussion in the foregoing, the proposed study aims to achieve the following objectives.

1. To identify integrated elements of public investment system in India and develop an Interpretive Structural Model of public investment system in India

2. To design alternative scenarios for public investment strategies in Indian context
3. To develop a system dynamics model of public investment system of Indian economy
4. To provide policy guidelines for development of a software-based application for conscious decision-making, related with public investment in Indian economy.

SECTION V

RESEARCH DESIGN, TOOLS AND METHODOLOGY

It is proposed that the research will be conducted in a phased manner, for which a series of workshops involving domain experts will be organized.

5.1 TOOLS AND TECHNIQUES OF SYSTEMS APPROACH

5.1.1 IDEA GENERATION

Solution to any problem requires alternative options. Most often, the options are not readily available and may have to be arrived at by generating new ideas. Therefore, idea generation becomes one of the first steps for developing policies and programs to achieve expected results in any system. Ideas can be generated using various techniques.

5.1.1.1 BRAINSTORMING

Brainstorming is one of the most popular techniques involving a group of persons to generate ideas in the context of a given situation or problem. Usually, there is a free flow of ideas amongst the participants in brainstorming. However, quite often the process gets limited to listing of ideas rather than following them up with analysis during the brainstorming exercise. Many times, the ideas may be shortlisted with or without prioritizing them.

5.1.1.2 Idea Engineering

Idea Engineering is a structured approach to generate ideas. It may be done formally by using a structured questionnaire. Usually, the structured questionnaire contains questions relevant to the problem at hand and the participants are required to pen down their response in the space provided below each question. Once the ideas are collected, ambiguities and duplications are removed, and priority is assigned to the ideas collectively after voting.

5.1.1.3 Idea Writing

In this variant of idea generation, about 8-10 expert participants write down and present their ideas about possible policy options and performance indicators in respect of a given problem. The participants also react to each others' views in writing. Finally, the principal idea is expected to emerge from their written interactions and group discussions, which is summarized as input for policy formulation. This methodology was propounded by Warfield and others, and is also referred to as Brain Writing.

5.1.1.4 Nominal Group Technique (NGT)

Typically, a group formed for generating ideas through NGT consists of domain experts, who are generally not working together as a group. So, participants are made to operate as a nominal group. There is no need for interaction amongst the participants, at least at the initial stages. They are asked to pen down their ideas individually, in silence, on one or more sheets of paper. This ensures that everyone participates. Once the ideas are generated, they are recorded, discussed, and redundancies are done away with. This is followed by voting of participants on the ideas finalized in the previous step and a weighted list of ideas is prepared. The most important ideas with high priority are usually selected for further research or management decisions.

5.1.2 INTERPRETIVE STRUCTURAL MODELING

This modelling approach involves pair-wise comparison of the elements of a given system in terms of a chosen contextual relationship. The reachability matrix obtained from such comparison leads to a hierarchical structure that avoids cyclical redundancies and provides a clear understanding of the system. The model obtained can be utilized in assessing the relative positions and importance of the elements at different levels of the structure for efficient policy planning.

5.1.3 DELPHI TECHNIQUE

Delphi technique entails collection of responses from domain experts on a given questionnaire, sharing the collective response of the participants with them and seeking their responses iteratively, until a fair consensus is obtained. So, it is a consensus building technique and is generally used to derive a futuristic status of the system concerned in a given context.

5.1.4 HARVA METHOD

This method is an effective way of assessing the current status of a given system, its trend scenario and the future scenario with help of groups of domain experts. It also leads to suggestions by the experts' groups for action plan/s to achieve the desired status of that system.

5.1.5 FUZZY ANALYSIS

According to the basic set theory on Mathematics, any given item is either a member of a set (1) or it is not (0). But in real life, the boundaries of human systems are not so precise and the situation may be understood better with the help of a fuzzy set, which is characterized by membership function, lying in the interval between (0) and (1). Giving the option of fuzzy responses to experts is a better way for capturing their mental reaction to the variety of options with required discretization on a chosen scale of responses for making decisions. Fuzzy considerations can be integrated with other techniques and methods for systemic assessments, as and when required.

5.1.5 OPTION PROFILING

An option profile is basically a subset of a universal set of system elements, organized hierarchically in terms of a contextual relationship to achieve a given objective. Alternative profiles can be designed for similar or different objectives for any system. Option profiles help in planning in a focused manner to achieve the concerned objectives, instead of wasting efforts and resources on elements that are not relevant for the chosen option profile.

5.1.6 ANALYTIC HIERARCHY PROCESS (AHP)

AHP is a decision making technique that involves comparison of alternatives on a given set of criteria to achieve a desired goal. The decision for choosing an alternative over the others depends on the overall assessment, based on the collective advantages in terms of the given criteria.

5.1.7 SYSTEM DYNAMICS APPROACH

Systems Dynamics approach differs from a simple cause-to-effect linear systems approach, in that the former represents a more comprehensive circular view, incorporating the feedback to the concerned system within the dynamic framework of the constituent elements. It combines management skills with cybernetics and computer simulations for policy considerations and effective decision making.

5.2 PHASES OF THE STUDY

5.2.1 PHASE 1 - IDENTIFICATION OF INTEGRATED ELEMENTS FOR PUBLIC INVESTMENT SYSTEM

This being the initial phase of research, the basic work of identifying the integrated constituent elements of the Public Investment System will be undertaken in this phase. Systems tools like Nominal Group Technique will be used to generate the ideas and prioritise them in response to a problem statement.

5.2.2 PHASE 2 - DEVELOPMENT OF AN INTERPRETIVE STRUCTURAL MODEL OF PUBLIC INVESTMENT SYSTEM

In this phase, the integrated elements will be shortlisted and subjected to pairwise comparison, to arrive at a hierarchical structure based on relevant contextual relationship between the system elements.

5.2.3 PHASE 3 - OPTION PROFILING AND COMPARISON OF OPTIONS

This phase will be concerned with development of alternative profiles for probable goals to be achieved, and their comparison using Analytical Hierarchical Process.

5.2.4 PHASE 4 - DELPHI STUDY, SCENARIO BUILDING AND DESIGNING OF ALTERNATIVE SCENARIOS.

This phase will be devoted to studying the trend of public investment practices and forecasting futuristic scenarios, using systems tools like Delphi technique and Harva Method. The alternative scenarios will be compared with the help of experts and by subjecting the results to fuzzy analysis.

5.2.5 PHASE - 5 SYSTEM DYNAMIC MODELLING OF PUBLIC INVESTMENT SYSTEM OF INDIA

In this phase, System Dynamics methodology will be applied to model the Public Investment System to study the dynamic nature of the system and the impact of changes in the status of various system elements on it.

5.2.6 PHASE - 6 DEVELOPMENT OF A SUITABLE APPLICATION SOFTWARE FOR CONSCIOUS DECISION-MAKING, RELATED WITH PUBLIC INVESTMENT IN INDIAN ECONOMY.

This would be the last phase of the study when the results of previous phases will be utilised to develop a software-based application for conscious decision-making, related with public investment in Indian economy

5.3 SCOPE OF THE STUDY

The scope of the study is limited to the public investment system in Indian economy. The study may cover global approaches or private investment to the extent that it may be necessary in the context of public investment in India.

5.4 SAMPLING PLAN

The sampling for collecting data in workshops or otherwise will be mainly judgmental, involving policy makers, economists, and academicians. Convenience sampling may also be resorted to while involving consumers, business personnel, and the like.

5.5 MANAGERIAL IMPLICATIONS AND OUTCOMES

Summary of the expected outcomes and benefits of the research are as under:

- A comprehensive list of elements having implications on the Public Investment System, to help the policy makers, would be the basic research output of this study.
- A hierarchical structure of various elements involved in the Public Investment System would provide the policy makers a clearer understanding of the sequential importance of different elements in achieving a desired goal.
- Forecasting of scenarios of Public Investment in the future will be another important output of this research for long-term perspective planning.
- The research output would lead to an optimal action plan for the decision makers to improve efficiency in the Public Investment System of India.
- Policy guidelines for application software may eventually assist the policy makers in planning and executing the planned programme with better efficiency, leading to necessary satisfaction of the stakeholders such as the government and all others positively concerned with the economy.

SECTION VI

PROPOSED CHAPTERIZATION

1. Introduction
    - 1.1. Economy and Investment
        - 1.1.1. Global Economy (Current Scenario)
        - 1.1.2. National Economy (Current Scenario)
        - 1.1.3. Role of Public Investment in Economic Development
        - 1.1.4. Historical Perspective of Public Investment in India
    - 1.2. Systems Approach to Problem Solving
        - 1.2.1. Policy Formulation Model and Process
        - 1.2.2. Need for Systems Approach
2. Literature Review
    - 2.1. Economy and Public Investment
    - 2.2. Systems Approach
    - 2.3. Conceptualization of the Problem
3. Need and Objectives
    - 3.1. Need of the Study
    - 3.2. Objectives of the Study
4. Research Design, Tools and Methodology
    - 4.1. Tools and Techniques of Systems Approach
        - 4.1.1. Idea Generation
        - 4.1.2. Interpretive Structural Modelling
        - 4.1.3. Delphi Technique
        - 4.1.4. Harva Method
        - 4.1.5. Fuzzy Analysis
        - 4.1.6. Option Profiling
        - 4.1.7. Analytic Hierarchy Process
        - 4.1.8. System Dynamics Approach

4.2 Phases of the Study

4.2.1. Phase 1 - Identification of Integrated Elements for Public Investment System

4.2.2. Phase 2 - Development of an Interpretive Structural Model of Public Investment System

4.2.3. Phase 3 - Delphi Study, Scenario Building and designing of alternative scenarios

4.2.4. Phase 4 - Option Profiling and Comparison of Options

4.2.5. Phase - 5 System Dynamic Modelling of Public Investment System of India

4.2.6. Phase - 6 Development of a suitable application software for conscious decision-making, related with public investment in Indian economy

5. Identification of integrated policy elements and Interpretive Structural Modeling of policy elements of Public Investment System of India

5.1 Introduction

5.2 Methodology

5.3 Identification of Policy Elements

5.4 Interpretive Structural Modelling

5.5 Option Profile Modelling

5.5.1 Evaluation of Profiles using Analytic Hierarchy Process

5.6 Conclusion

6. Delphi study and application of Harva method to forecasting and scenario building of Public Investment System

6.1 Introduction

6.2 Methodology

6.3 Delphi Study

6.3.1. Analysis of Results

6.4 Application of Harva Method

6.4.1 Analysis of Results

6.5 Fuzzy Dominance Order Evaluation of Alternative Scenarios

6.6 Conclusion

7. Application of System Dynamics and software for public investment

7.1 Introduction

7.2 Development of Systems Dynamics Model of Public Investment System of India

7.3 Software Development

7.4 Conclusion

8. Conclusions

8.1 Introduction

8.2 Research Contributions

8.3 Policy recommendations

8.4 Limitations

8.5 Directions for future research

List of abbreviations, References, Acknowledgement, Appendices, etc. will be mentioned in appropriate sequence as integral part of the thesis.

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